(I) CLAIMS

We claim:

1. A pharmaceutical composition comprising ADDLs capable of generating an immune response in a host organism, wherein the composition is a vaccine or a component of a vaccine.

2. The pharmaceutical composition of claim 1, wherein the composition is capable of generating an ADDL-blocking immune response when administered to a host organism.

3. The pharmaceutical composition of claim 1, wherein the composition is capable of generating anti-ADDL antibodies when administered to a host organism.

4. The pharmaceutical composition of claim 1, wherein the composition is capable of preventing AD, memory and learning deficits, degeneration or malfunction of neurons when administered to a host organism.

5. The pharmaceutical composition of claim 1, wherein the composition is capable of amelioration of AD, memory and learning deficits, degeneration or malfunction of neurons when administered to a host organism.

6. A pharmaceutical composition comprising ADDLs, wherein the ADDLs are antigenic, immunogenic or act as a binding molecule when the composition is administered to a host organism.

7. The pharmaceutical composition of claim 6, wherein the composition is used to generate ADDL-blocking antibodies.

8. The pharmaceutical composition of claim 6, wherein the composition is used to generate ADDL-blocking antibody fragments, single chain antibodies or any other antibody mimic.

9. The pharmaceutical composition of claim 6, wherein the composition is used to generate ADDL-blocking binding molecules.

10. The pharmaceutical composition of claim 6, wherein the composition is used to select or identify ADDL-blocking molecules

11. A composition comprising an epitope or collection of epitopes that can generate an ADDL-blocking immune response when administered to a host organism.

12. A composition comprising an epitope or collection of epitopes that can generate anti-ADDL antibodies when administered to a host organism.

13. A composition comprising an epitope or collection of epitopes that can prevent AD, memory and learning deficits, degeneration or malfunction of neurons when administered to a host organism.

14. A composition comprising an epitope or collection of epitopes that can ameliorate AD, memory and learning deficits, degeneration or malfunction of neurons when administered to a host organism.

15. A composition comprising an epitope or collection of epitopes that can generate ADDL-blocking antibodies.

16. A composition comprising an epitope or collection of epitopes that can generate ADDL-blocking antibody fragments, single chain antibodies or any other antibody mimic.

17. A composition comprising an epitope or collection of epitopes that can generate ADDL-blocking binding molecules.

18. A composition comprising an epitope or collection of epitopes that can select or identify ADDL-blocking molecules.

19. A peptide or peptide mimic capable of assembly into oligomers, wherein said oligomers are capable of generating an ADDL blocking immune response when administered to a host organism.

20. A peptide or peptide mimic capable of assembly into oligomers, wherein said oligomers are capable of generating anti-ADDL antibodies when administered to a host organism.

21. A peptide or peptide mimic capable of assembly into oligomers, wherein said oligomers are capable of preventing AD, memory and learning deficits, degeneration or malfunction of neurons when administered to a host organism.

22. A peptide or peptide mimic capable of assembly into oligomers, wherein said oligomers are capable of amelioration of AD, memory and learning deficits, degeneration or malfunction of neurons when administered to a host organism.

23. A peptide or peptide mimic capable of assembly into oligomers, wherein said oligomers are useful in generating ADDL-blocking antibodies.

24. A peptide or peptide mimic capable of assembly into oligomers, wherein said oligomers are useful in generating ADDL-blocking antibody fragments, single chain antibodies or any other antibody mimic.

25. A peptide or peptide mimic capable of assembly into oligomers, wherein said oligomers are useful in generating ADDL-blocking and/or binding molecules.

26. A peptide or peptide mimic capable of assembly into oligomers, wherein said oligomers are useful in selecting or identifying ADDL-blocking molecules.

27. A peptide or peptide mimic containing specific structural elements that enable the formation of an internal beta sheet, the formation of which enables assembly into oligomers, which are capable of generating or selecting anti-ADDL antibodies or binding molecules.

28. A peptide or peptide mimic containing specific structural elements that enable the formation of an internal C-terminal beta sheet, the formation of which enables assembly into oligomers, which are capable of generating or selecting anti-ADDL antibodies or binding molecules.

29. A peptide or peptide mimic containing the motif:

R-XXXX
Z
XXXX

wherein Z is glycyl glycyl, prolyl, any other dipeptide or dipeptide capable of forming a beta-turn, or any other beta-turn mimic, and where X is any amino acid or amino acid mimic, the presence of which enables the assembly of said peptide or peptide mimic into oligomers, which are capable of genrating or selecting anti-ADDL antibodies or binding molecules.

30. A dipeptide functionalized beta turn mimic capable of assembling into oligomers, which are capable of genrating or selecting anti-ADDL antibodies or binding molecules.

31. A peptide or peptide mimic comprising specific structural elements that enable the formation of an internal C-terminal beta sheet, the formation of which enables assembly into oligomers comprising one or more ADDL epitopes.

32. A peptide comprising the sequence:

DSGYEVQQQKLVFFAEDVGSNKGAIIGLMV
G
G
AIVV

capable of assembling into oligomers that are capable of generating or selecting anti-ADDL antibodies or binding molecules, but are incapable of generating antibodies or other molecules that bind amyloid monomer or fibrillar aggregates.

33. A peptide comprising the sequence:

DSGYEVQQQKLVFFAEDVGSNKGAIIGLMV
G
G
VAIVV

capable of assembling into oligomers that are capable of generating or selecting anti-ADDL antibodies or binding molecules, but are incapable of generating antibodies or other molecules that bind amyloid monomer or fibrillar aggregates.

34. A peptide comprising the sequence:

DSGYEVQQQQLVFFAEDVGSNKGAIIGLMV
G
G
VAIVV

capable of assembling into oligomers that are capable of generating or selecting anti-ADDL antibodies or binding molecules, but are incapable of generating antibodies or other molecules that bind amyloid monomer or fibrillar aggregates.

35. A peptide comprising the sequence:

DVGSNKGAIIGLMV
G
G
VAIVV

capable of assembling into oligomers that are capable of generating or selecting anti-ADDL antibodies or binding molecules, but are incapable of generating antibodies or other molecules that bind amyloid monomer or fibrillar aggregates.

36. A peptide comprising the sequence:

DVGSNKGAIIALMV
G
G
VAIVV

capable of assembling into oligomers that are capable of generating or selecting anti-ADDL antibodies or binding molecules, but are incapable of generating antibodies or other molecules that bind amyloid monomer or fibrillar aggregates.

37. A peptide or peptide mimic composition comprising a portion of an amyloid $\beta$ sequence, wherein the sequence has been truncated at the N-terminus and the positively charged residues have been removed such that the generation of fibril-reactive antibodies is avoided when the composition is administered to a host organism.

38. A peptide or peptide mimic composition comprising a portion of an amyloid $\beta$ sequence, wherein the sequence has been modified at the C-terminus in order to promote oligomer assembly when the composition is administered to a host organism.

39. A binding molecule capable of recognizing oligomeric A$\beta$, with no cross-reactivity to monomer or fibril amyloid.

40. The molecule of claim 39 where the molecule is an antibody or antibody fragment.

41. The molecule of claim 39 where the molecule is a monoclonal antibody or monoclonal antibody fragment.

42. The molecule of claim 39 where the molecule is a human or humanized monoclonal antibody or antibody fragment.

43. Monoclonal antibody 3B7, which is capable of recognizing oligomeric Ab but not monomer or fibril amyloid.

44. Monoclonal antibody 11B5, which is capable of recognizing oligomeric Ab but not monomer or fibril amyloid.

45. Monoclonal antibody 5A9, which is capable of recognizing oligomeric Ab but not monomer or fibril amyloid.

46. A method of using the antibodies in any one of claims 39-45 as antigens to raise anti-idiotype antibodies, which are useful as vaccine immunogens to trigger therapeutic immune responses that block ADDL activity.

47. A method of using the antibody in claim 42 as a therapeutic antibody for protection of nerve cells from ADDL induced toxicity.

48. A method of using the antibody in claim 42 as a therapeutic antibody for reversal of memory deficits in transgenic Alzheimer model mice.

49. A method of using the antibody in claim 41 as a therapeutic antibody for reversal of memory deficits in transgenic Alzheimer model mice.

50. A method of using the antibody in claim 42 as a therapeutic antibody for reversal of memory deficits in humans.

51. A method of using the antibody in claim 42 as a therapeutic antibody for prevention or therapy of Alzheimer's disease, Down's syndrome, mild cognitive impairment and other diseases involving memory deficits in humans.

52. A method of using the molecules in any one of claims 39-42 as diagnostic reagents for detection of ADDLs in serum, cerebrospinal fluid or post-mortem brain tissue.

53. A method of using the molecules of claim 41 as templates for the design of human or humanized monoclonal antibodies.

54. A method of treatment of AD, Down's, MCI and related memory deficit disorders where the method comprises administration of the molecule of claim 42 or pharmaceutically accepted formulations comprising the molecule of claim 42.